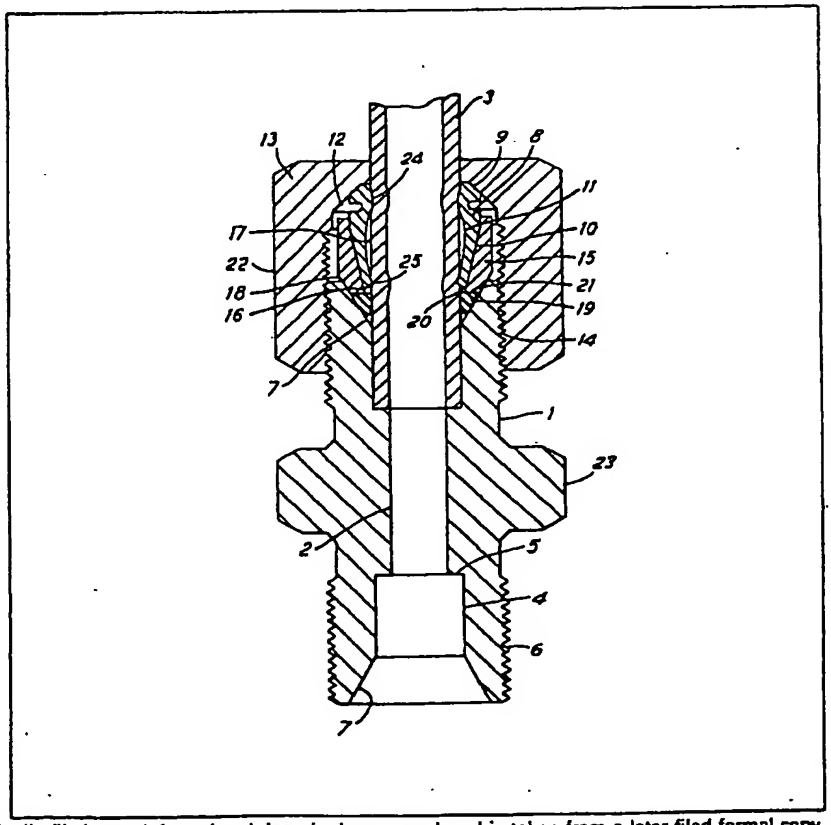
(12) UK Patent Application (19) GB (11) 2 080 900 A

(21) Application No 8024279
(22) Date of filing
24 Jul 1980
(43) Application published
10 Feb 1982
(51) INT CL³ F16L 19/08
(52) Domestic classification
F2G 22A
(56) Documents cited
None
(58) Field of search
F2G
(71) Applicant
Waverley Components & Products Ltd
Kebbell House
Carpenders Park
Watford
Herts WD1 3BF
(72) Inventor
Denis Richard Henry Mitchell
(74) Agents
Mewburn Ellis & Co
70/72 Chancery Lane
London WC2A 1AD

# (54) Tube compression coupling

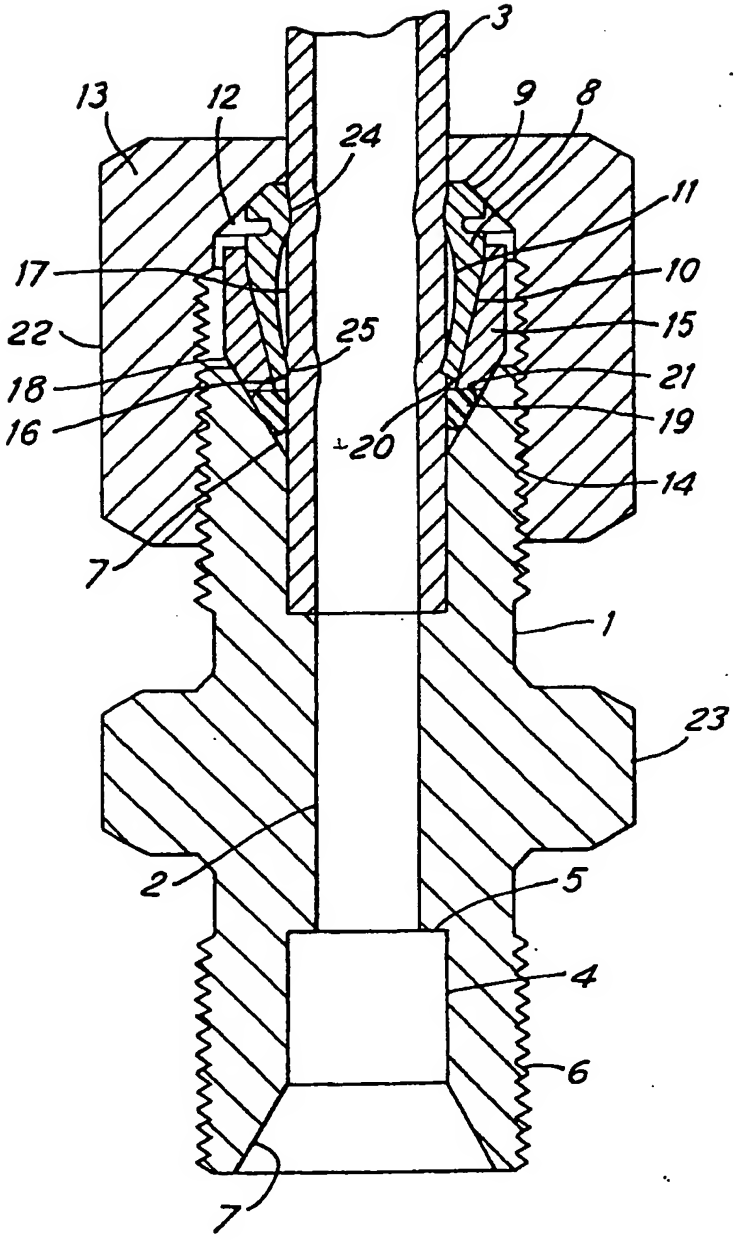
(57) A tube compression coupling comprising a coupling body 1, a first ferrule 8, a second ferrule 15, an O-ring 19 and a retaining member 13. The inner ferrule 8 is a compressible ferrule which forms a seal with the tube 3 whilst the outer ferrule 15 forms seals with the inner ferrule 8 and with the coupling body 1 by means of a 60° cone 18 and corresponding seat 7 in the coupling body 1. The two ferrules 8, 15, together with the tube 3 and coupling body 1 form an annular space wherein the O-ring 19 is retained in sealing contact with the tube 3 and the coupling body 1 by the ferrules 8, 15 without the O-ring 19 being damaged on the tightening of the compression coupling by tightening retaining member 13 which is in threaded engagement with coupling body 1. This enables an O-ring 19 to be used in a compression coupling in such a way that it only experiences a pre-determined amount of deformation to provide a seal.




The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

GB 2 080 900 A

2080900



SPECIFICATION

**Tube compression coupling**

The present invention relates to compression couplings for coupling pipes or tubes to other fittings or tubes, particularly but not exclusively to such couplings for use in high pressure systems where joints able to withstand high pressures of the order of thousands of lbs.f in$^2$ without leaking are required.

It is well known to provide tube compression couplings which involve metal to metal seals. However when gases of relatively small molecular size are used in high pressure systems, it is often difficult to eliminate residual leaks resulting from the use of metal to metal seals. Often the adjustment required to eliminate a leak at one joint in a system results in its reappearance at another joint due to the difficulty of achieving a perfect seal with metal to metal seals.

The use of O-rings made of rubber or some other resilient material is common in low pressure systems and they can provide very good seals under such conditions.

However the successful use of such O-rings in high pressure joints is difficult to achieve for a number of reasons. The good seals provided by O-rings in low pressure systems are due to their deformability which allows them to achieve a good seal with the two surfaces with which they are in contact. In high pressure systems however their deformability is a disadvantage as the high pressure will cause them to deform to give an imperfect seal and even to be extruded of the joint altogether resulting in a substantial leak.

It is an object of this invention to provide a tube compression joint which will provide a good seal at high pressures by utilising a metal to metal seal in combination with a seal provided by a resilient O-ring.

According to the present invention there is provided a tube compression coupling which comprises a radially deformable first ferrule having a flaring outer surface and adapted to form a seal between its inner surface and the outer surface of the tube when deformed radially inwardly, a second ferrule having a flaring inner surface which receives said outer surface of said first ferrule and causes said first ferrule to deform inwardly when the first ferrule is urged axially into said second ferrule, a coupling body having a surface which forms an abutment for axial location of said second ferrule, an O-ring to form a seal between an inner surface of said coupling body and the outer surface of the tube, and O-ring being confined, when the coupling is formed, in an annular space bounded by said second ferrule, the outer surface of the tube and said inner surface of said coupling body so as to form said seal, and a retaining member which in use is mounted on the tube and engages threadedly with said coupling body so as to urge said first ferrule axially into said second ferrule and to retain said ferrules, coupling body and O-ring in position.

The invention overcomes the disadvantages of using either just a metal to metal seal or just an O-ring seal in a high pressure compression joint, by combining the two together. However it is essential to avoid the compression or deformation of the O-ring by the action of the compression joint as this would result in a reduction or the destruction of its sealing ability but at the same time to retain the O-ring within the joint. In the invention, the O-ring is compressed within an annular space of predetermined size. The proven strength of a conventional compression ferrule will thus be combined with the total seal of an O-ring.

Preferably the surface of the coupling body against which the second ferrule abuts is part of the said inner surface of the coupling body, this inner surface being flaring and the second ferrule having a complementary flaring outer surface.

Preferably the engagement of the first and second ferrules provides a seal between them. Preferably also, the engagement of the second ferrule and the coupling body provides a seal between them.

In addition to its outer flaring surface which engages the second ferrule, the first ferrule is also preferably provided with a second flaring outer surface which is acted on by the retaining member so as to cause radial compression of the first ferrule at a second location spaced from the radial compression caused by the second ferrule. The flaring surfaces provided in certain of the component parts of the invention also ensure that the assembly remains concentric.

The coupling body may form a union of a piece of apparatus to which a tube is to be attached or may be a connector to join together lengths of pipe which may be of similar or different dimensions.

The materials from which the joint components are manufactured with the exception of the O-ring are preferably metal and more preferably 316 stainless steel, which is highly resistant to corrosion, through any suitable material for the purpose for which the joint is to be used may be employed.

The O-ring may be manufactured from any suitable resilient material such as rubber, p.t.f.e., or the like depending on the conditions under which the joint is to be used. The O-ring may be of any suitable cross section.

The invention thus has the advantages that it combines the effective seal provided by an O-ring with the high pressure capabilities of a compression joint. The invention also has the advantage that it may be employed using standard coupling bodies compression ferrules and retaining bodies.

An embodiment of the invention will now be described in more detail with reference to the accompanying drawing, in which:
the single figure is a cross sectional view of a tube compression coupling embodying the present invention.

The figure shows a cross sectional view of a tube connector for joining two tubes of the same diameter and thickness. Part of one tube only is shown. A coupling body 1 has a bore, a part 2 of which has the same internal diameter as the tube 3. A further part 4 of the bore of the coupling body has as its internal diameter the external diameter of the tube. An abutment or step 5 formed between the surfaces 2 and 4 acts as a tube stop. The coupling body is also provided with a threaded outer surface 6 and an inner frustoconical sealing surface 7 which forms an acute angle with the outer surface of the tube 3. This angle is preferably the standard 30° as shown in the figure. the inclusive angle of the frustoconical sealing surface 7 being 60°.

The first ferrule 8 has a frustoconical bearing surface 9, a frustoconical outer sealing surface 10, and an inner surface 11. The top angle of the frustoconical bearing surface 9 is preferably 90° inclusive and the angle of the frustoconical sealing surface 10 is preferably 24° inclusive. The inner surface 11 is parallel with the surface of the tube 3 over which it has a small clearance. The bearing surface 9 is acted on by a corresponding inner bearing surface 12 of the retaining member or nut 13. The retaining member 13 is also provided with a threaded portion 14 on a part of its inner surface which engages with the threaded portion 6 of the coupling body 1 and on tightening urges the first ferrule 8 towards the coupling body 1 by means of the bearing surfaces 9, 12.

The second ferrule 15 is provided with an inner frustoconical sealing surface 16 which in the completed coupling is in sealing engagement with the outer surface 10 of the first ferrule. The ferrule 15 is also provided with an outer frustoconical sealing surface 18 which is in sealing engagement with the inner sealing surface 7 of the coupling body and the sealing surface 18 thus forms a 60° cone on the coupling body end of the second ferrule 15.

The O-ring 19 is situated in the annular gap formed by the outer surface of the tube 3, the end of the ferrule 15 and the inner sealing surface 7 of the coupling body 1. The ends 20, 21 of the ferrules 8, 15 are preferably flush or nearly flush so that the end 21 of the second ferrule overhangs the end 20 of the first ferrule as little as possible, thus the O-ring will not tend to be extruded into the gap formed by the overhang of the second ferrule. The sizes of the components defining the annular gap containing the O-ring and size of the O-ring 19 are selected so that the O-ring is retained in sealing engagement with the outer surface of the tube 3 and with the inner sealing surface 7 of the coupling body 1 without destruction of the O-ring through over compression or the O-ring being exuded into gaps formed for example by the overhang of the end 20 of the first ferrule 8 by the end 21 of the second ferrule 15. The volume of the annular gap should thus at least be substantially equal to but not less than the volume of the O-ring 19. The outside diameter of the O-ring is preferably the same diameter as the outer peripheral diameter of the end 21 of the second ferrule 15.

In order to assemble the joint the following procedure is adopted. The retaining member 13, the first ferrule 8, the second ferrule 15, the O-ring 19 are each in turn threaded onto the tube 3 and the tube end inserted into the end of the coupling body 1 until it reaches the abutment 5. The O-ring is then pushed down the tube until it is located against the inner sealing surface of the coupling body 1. The retaining member is then engaged with the coupling body 1 by means of the threaded portions 6 and 14 and the two tightened together by means of the spanner-engaging surfaces 22 and 23.

On tightening together the retaining member 13 and coupling body 1 the first ferrule 8 is radially compressed such that it engages and forms a seal with the outer surface of the tube 3 at two longitudinally spaced circumferential locations 24, 25 as a result of the ramp-like compressing action of the second ferrule 15 and the engagement of the surface 12 of the retaining member 13 with the surface 9 of the first ferrule 8. The second ferrule 15 is retained in position by the inner sealing surface of the coupling body 1 with which it forms a seal as well as forming one with the outer surface 10 of the first ferrule 8.

CLAIMS

1. A tube compression coupling which comprises a radially deformable first ferrule having a flaring outer surface and adapted to form a seal between its inner surface and the outer surface of the tube when deformed radially inwardly, a second ferrule having a flaring inner surface which receives said outer surface of said first ferrule and causes said first ferrule to deform inwardly when the first ferrule is urged axially into said second ferrule, a coupling body having a surface which forms an abutment for axial location of said second ferrule, an O-ring to form a seal between an inner surface of said coupling body and the outer surface of the tube, the O-ring being confined, when the coupling is formed, in an annular space bounded by said second ferrule, the outer suface of the tube and said inner surface of said coupling body so as to form said seal, and a retaining member which in use is mounted on the tube and engages

threadedly with said coupling body so as to urge said first ferrule axially into said second ferrule and to retain said ferrules, coupling body and O-ring in position.

2. A coupling according to claim 1 wherein the surface of the coupling body against which the second ferrule abuts is part of the said inner surface of the coupling body, this inner surface being flaring and the second ferrule having a complentary flaring outer surface.

3. A coupling according to claim 1 or claim 2 wherein the outer surface of the first ferrule and the inner surface of the second ferrule are complementary frustoconical surfaces.

4. A coupling according to claim 3 as dependent on claim 2 wherein the angle of said frustoconical inner surface of said second ferrule is less than the angle of said frustoconical outer surface of said second ferrule.

5. A coupling according to any one of the preceding claims wherein the engagement of the first and second ferrules provides a seal between them.

6. A coupling according to any one of the preceding claims wherein the engagement of the second ferrule and the coupling body provides a seal between them.

7. A coupling according to any one of the preceding claims wherein in addition to its outer flaring surface which engages the second ferrule the first ferrule is provided with a second flaring outer surface which is acted on by the retaining member to cause additional radial deformation at a second location spaced from the deformation caused by the second ferrule.

8. A coupling according to any one of the preceding claims wherein said first ferrule or radial deformation grips the tube and forms seals with it at two longitudinally spaced circumferential locations.

9. A tube compression coupling substantially as herein described with reference to and as shown in the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1982.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.